Investigation on respirable particulates and trace elements with source identification in air environment of Korba

Supplement to the final report

Prepared for Central Mine Planning and Design Institute Limited,
Ranchi

TERI Project Report No. 97EE65

CMPDIL's COMMENTS ON DRAFT REPORT AND ACTION TAKEN BY TERI

1.0 The predominant wind direction during Summer and winter Seasons are from N, NE and N, NW respectively, but the reference monitoring station i.e. Nonbirra village has been set up in Western direction from mines. Ideal reference monitoring station would have been in Northern direction, upwind of NTPC and BALCO plant.

Comments

After reconnaissance of the entire study area, Nonbirra village was chosen for the background station. It is located about 15 km away from the Dipka OCP and more than 30 km from NTPC power plant. It was the consensus decision of officials from TERI, Gevra and CMPDIL, Bilaspur. Wind direction hardly remains towards west except for some time during summer. As we know, mining activities do not have impacts beyond 2-3 and hence, it is unlikely to have any impact from these activities in mines on background station.

2.0 Report does not contain analysis of past meteorological data. Analysis of the past data helps in better understanding of wind flow pattern in the area, which is very crucial for knowing the direction of dust drift from sources to various receptors and identification of critical receptors. The details of the meteorological data such as Temp., Wind velocity, Wind direction, Humidity, Rainfall, cloud cover etc. recorded during the study period should be included in the report.

Comments

Past meteorological data has been thoroughly analyzed and is given briefly in page 1 of chapter 1 under climate. While designing the monitoring stations, one of the most important criteria was meteorological parameter, especially wind direction. Maximum and minimum data for temperature and humidity during study period are given in chapter 3. Windrose diagram is already given for wind speed and direction.

3.0 Wind rose diagram for different seasons have been given for Stability Class 'A' only not for other stabilities. Further wind rose diagram for day and night hours have not been included in the report.

Comments

Windrose diagram for C and D class is given in attachment. Sampling was carried out for 24 hours in all the monitoring stations. Hence, windrose diagram for day and night is not given.

4.0 The report mentions about calibration of HVS and AAS only. What about the methodology and frequency of calibration of other equipment such as RDS, Cascade impactor, PDS, wind monitor etc. used during the study?

Comments

New RDS instruments were procured for the study. Calibration was done for all RDS before delivery, as part of condition for procurement. Servicing of all HVS and RDS was done by a shop approved by the Envirotech Instruments Limited at Korba before carrying out monitoring for each season to ensure proper functioning of the blower, its flow rate and pressure. Calibration for wind monitor was done twice during the entire study period from the Envirotech Instruments Ltd., Delhi. This is basically to ensure the proper functioning of the censors, cords and the data logger. 5 Stage Cascade Impactor was procured from Anderson, USA for the study. No calibration was made during the study period. For PDS, flow rate calibration has been carried out before and after any experiment to ensure the proper functioning of the pump. A sample copy of the flow rate calibration is included in the report (Annexure 8).

5.0 What is the minimum detection limit and error in analysis of trace elements by AAS (Model Analytik zena – 5 FL & - 5 HS)? It is very important to know these parameters for proper assessment of results.

Comments

A table included in the report (Annexure 7) giving minimum detection limit for all heavy metals.

6.0 What precautions have been taken to minimize matrix effect during analysis of trace elements? Some samples (about 2%) may be sent to other labs. or analysed by different methods for validation of the results.

Comments

Few samples have been analyzed from laboratory of Analytik Jena, Delhi for validation of results obtained by using our AAS. As TERI maintains a world class laboratory, top priority was given on quality control during analysis of samples.

7.0 The monitoring results of each station on each day of monitoring should be submitted for better comparison of monitoring data of different receptors under identical meteorological conditions.

Comments

Included in attachment.

8.0 In page no. 2, para 2, it is mentioned that "an estimated 482 tonnes of particulate matter is emitted every day in Korba area from various activities in mining, power and aluminium plants." What is the basis of this estimation and sourcewise break up of dust generation from various industrial activities?

Comments

Source: CPCB publication no. PROBES/54/1993-94 on Industry Specific Pollution Control Status in Problem Areas (Korba, Angul, Talcher, and Vishakhapatnam).

9.0 The concentration of SPM, RPM and trace metals at different receptors has been given in the report. The industrywise contribution of SPM, RPM and trace metals have not been brought out, which is one of the important objectives of the study. This will help in preparation of industry specific mitigation plan for the Korba area in future.

Comments

Objectives of the study are clearly given in page 5 of the report. To quantity industry wise contribution of SPM and PRM, it needs mathematical modelling, which was not the part of the objectives. From enrichment factor and factor analysis, it was possible to indicate the association of heavy metals to different sources. The methodology has been practiced in different parts of the world. The study essentially focussed on Korba coalfields. Recommendations made in the report, if adopted would certainly help to improve upon the air quality in the coalfields.

10.0 Characterisation of various types of dust (coal dust, o.b. dust, fly ash etc.) w.r.t. particle size analysis and chemical composition including trace metals will help in better interpretation of monitoring results.

Comments

It is given in attachment.

11.0 The average reported concentration of SPM and RPM at Nonbirra village, Gevra mine and Adarsh Nagar colony are as given below:

		Post-Monsoon		Winter	
Sl. No.	Location	SPM	RPM	SPM	RPM
1	Nonibira Village	90	49	78	51
2	Gevra Mine	773	363	520	431
3	Adarsh Nagar	201	76	182	134

The concentration of SPM is lower during winter seasons, whereas the corresponding RPM conc. are higher. This may be explained.

Comments

It has been recognised world over that air pollution is a complex phenomena. Data generated for one year may not enough to provide proper justification on seasonal variations. Data produced in the report is a statistical average. Higher concentration for few days might change the average value of particular season.

12.0 The average reported concentration of SPM and RPM at Korba town are as follows:

Season	Winter	Summer	Post-Monsoon	Monsoon
SPM	501	382	295	349
RPM	204	93	134	144

The average concentration of SPM and RPM during monsoon season is higher than during Post-Monsoon season. The reason should be elaborated.

Comments

Frequent rain during sampling period in post monsoon season may be the reason for lower concentration of SPM and RMP than monsoon season.

13.0 The seasonal variation of ratio of RPM to SPM, expressed in %, are as follows:

Sl. No.	Location	Winter	Summer	Post Monsoon	Monsoon	Average
1	Nonibira Village	65	61	54	59	60
2	Gevra Mine	83	48	47	21	50
3	Adarsh Nagar	74	40	38	51	51
4	GSI Camp Village	47	36	56	72	53
5	Manikpur colony	52	40	38	44	43
6	Korba town	41	24	45	41	38

The explanation for spatial and seasonal variation in the above data is not given in the report.

Comments

It is given in the report.

14.0 The size distribution of particulate matter obtained through five stage cascade impactor is given in Table 3.1. It is not clear from the report about the season in which these results were obtained. What is the seasonal variation in the size distribution?

Comments

The results produced in the report on particulate size distribution were obtained in summer season. Data obtained in winter season are almost the same as summer season. Hence, it is not given in the report.

15.0 The SPM concentration measured at about 20 m away from the coal transportation road (Near Adarsh Nagar) is 153 to 310 μg/cu.m during

Summer season, whereas the corresponding values in Adarsh Nagar colony (background concen.) is 99-532 µg/cu.m. It appears that SPM values at roadside are lower than the actual or may be the values recorded at upwind direction from the source.

Comments

Data reported for SPM concentration for Adarsh Nagar (Page 20) was 60-264 µg/m^3, whereas, concentration obtained in the roadside was 153-310 µg/m3. SPM concentration generally remained higher in road-side than Adarsh Nagar colony.

16.0 It is observed from Table 5.3, page 64 that sample six (n) is small for carrying out Statistical analysis of the data. The maximum value of n is 3.

Comments

Sample size was more than the reported one. But, to maintain the strict quality control, many of the samples were discarded. Reported values ensure the quality.

17.0 Free silica content of finer size particulate has not been reported. This may be incorporated in comparison of exposure levels of difference population groups.

Comments

Samples were given to Sri Ram Laboratory, Delhi and CFRI, Dhanbad for Free Silica Analysis. Results obtained could not satisfy us since reported values were found to be less than 0.1%. Hence, we have not given in the report.

18.0 It is reported that ratio of indoor to outdoor particulate matter is 0.36 and 0.8 for Gevra and Kusmunda area and daily exposure levels are higher in Gevra compared to Kusmunda. Is this finding supported by other indirect evidence such as higher % of respiratory diseases?

Comments

Attempts were made to obtain statistics from Gevra and Kusmunda hospitals on respiratory diseases. But we failed to get any statistics. But

19.0 The reference of National or International Standard for measurement of 'Indoor Air Quality' should be incorporated in the report.

Comments

There are no national and international standards available on indoor air quality.

20.0 The report does not mention about the existing dust control measures in Thermal Power Plants and Aluminum Plants and their effectiveness in controlling dust generations.

Comments

It was beyond the scope of the study (page 5 of the report).

21.0 The details of the trace element concentration in each sample at each station should be presented along with the statistical analysis of the data.

Comments

It is given.

22.0 The trace element concentration in RPM 10 and PM 5 has not been determined and correlated with size.

Comments

Heavy metals were analyzed for RPM 10. It was observed that there is no or very less variation of heavy metal concentration in SPM and RPM 10.

23.0 The report is silent about human exposure to trace metals in Korba Coalfields.

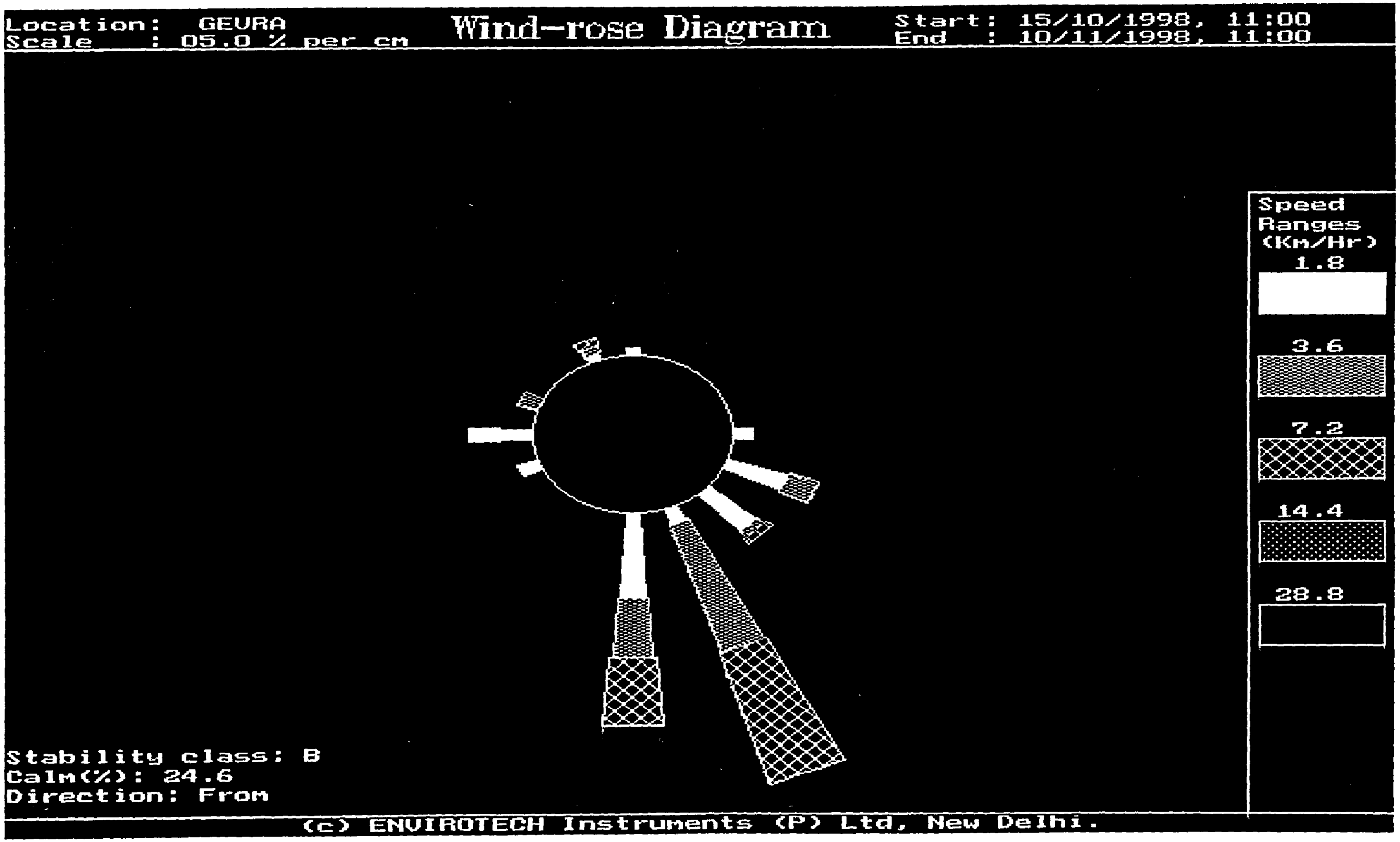
Comments

It is incorporated in the report.

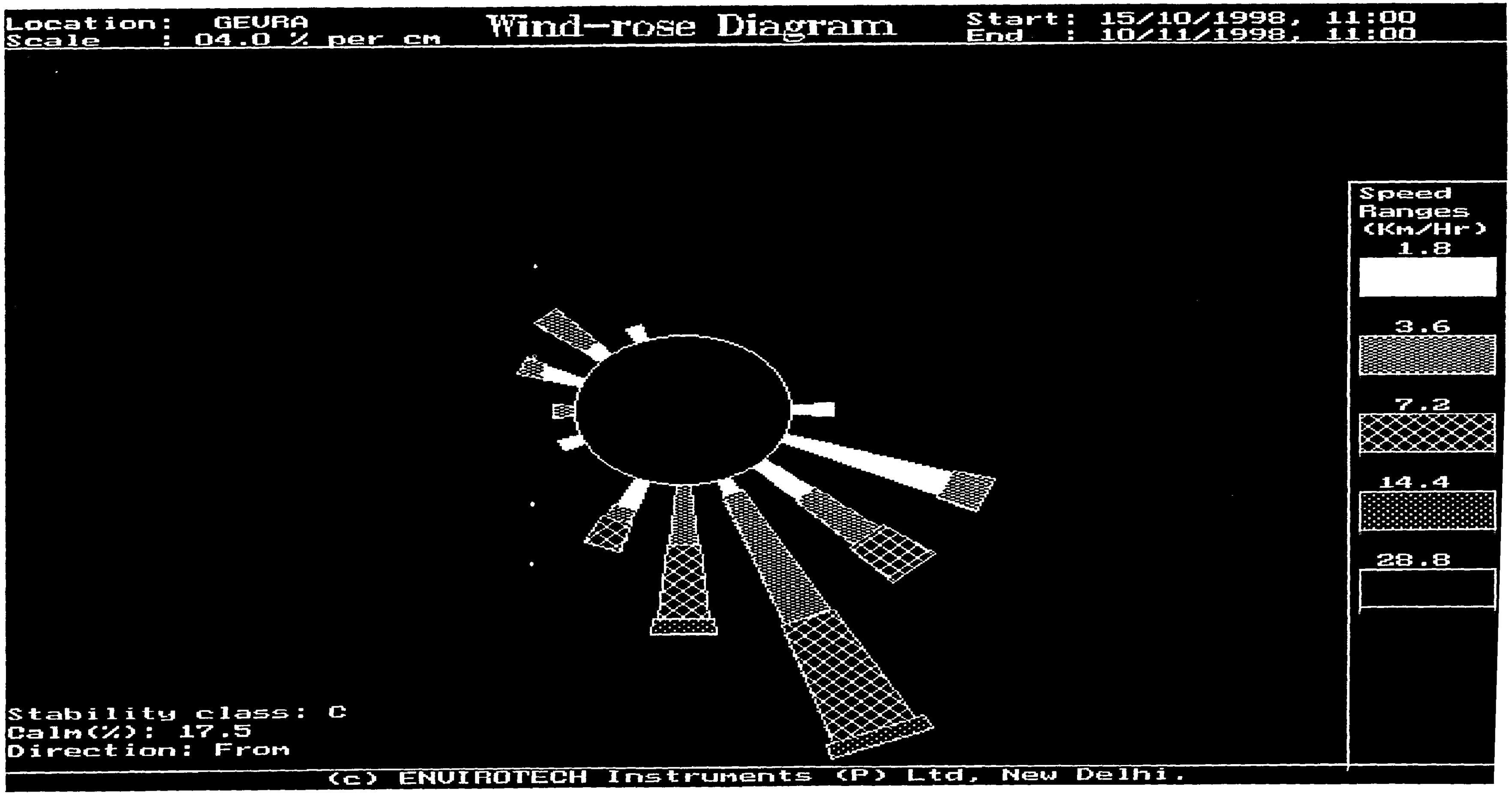
1

WINDROSE DIAGRAMS

Windrose for post monsoon season



Wind rose diagram for post monsoon season



Location: GEVRA
Scale : 04.0 % per cm

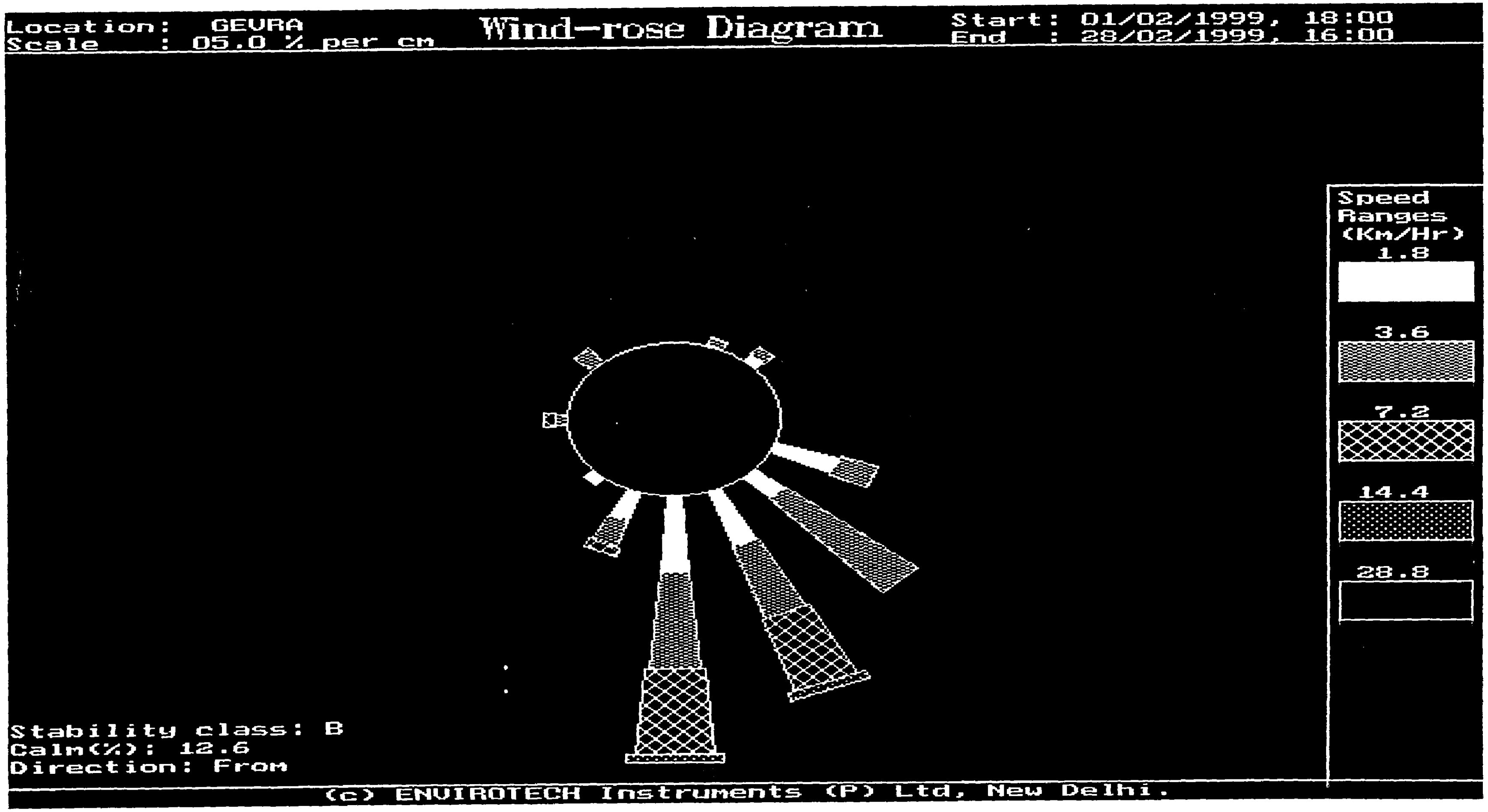
Wind-rose Diagram

Start: 15/10/1998, 11:00
End : 10/11/1998, 11:00

Stability class: C
Calm(%): 17.5
Direction: From

(c) ENVIROTECH Instruments (P) Ltd, New Delhi.

Wind rose for winter season



Location: GEVRA
Scale : 05.0 % per cm

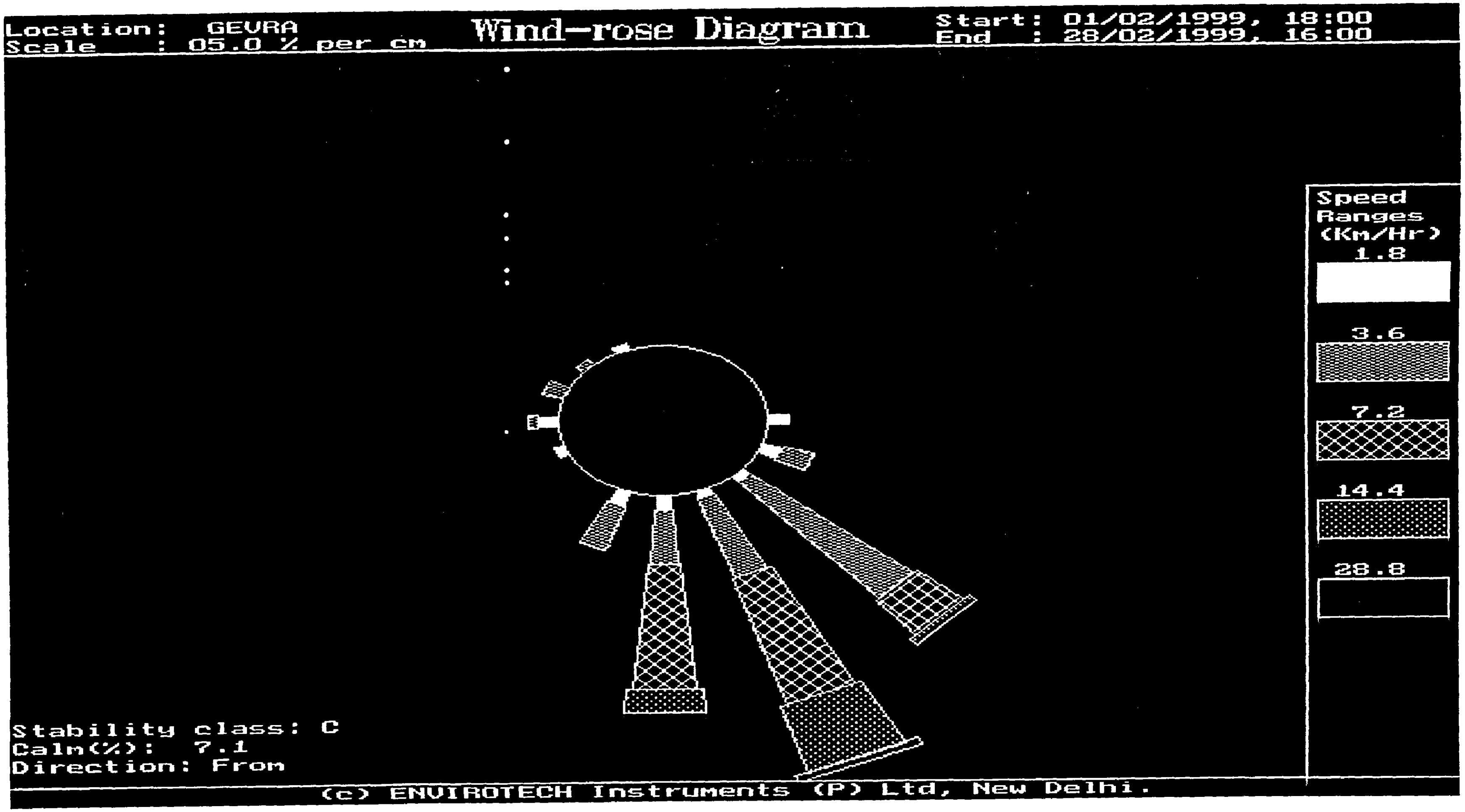
Wind-rose Diagram

Start: 01/02/1999, 18:00
End : 28/02/1999, 16:00

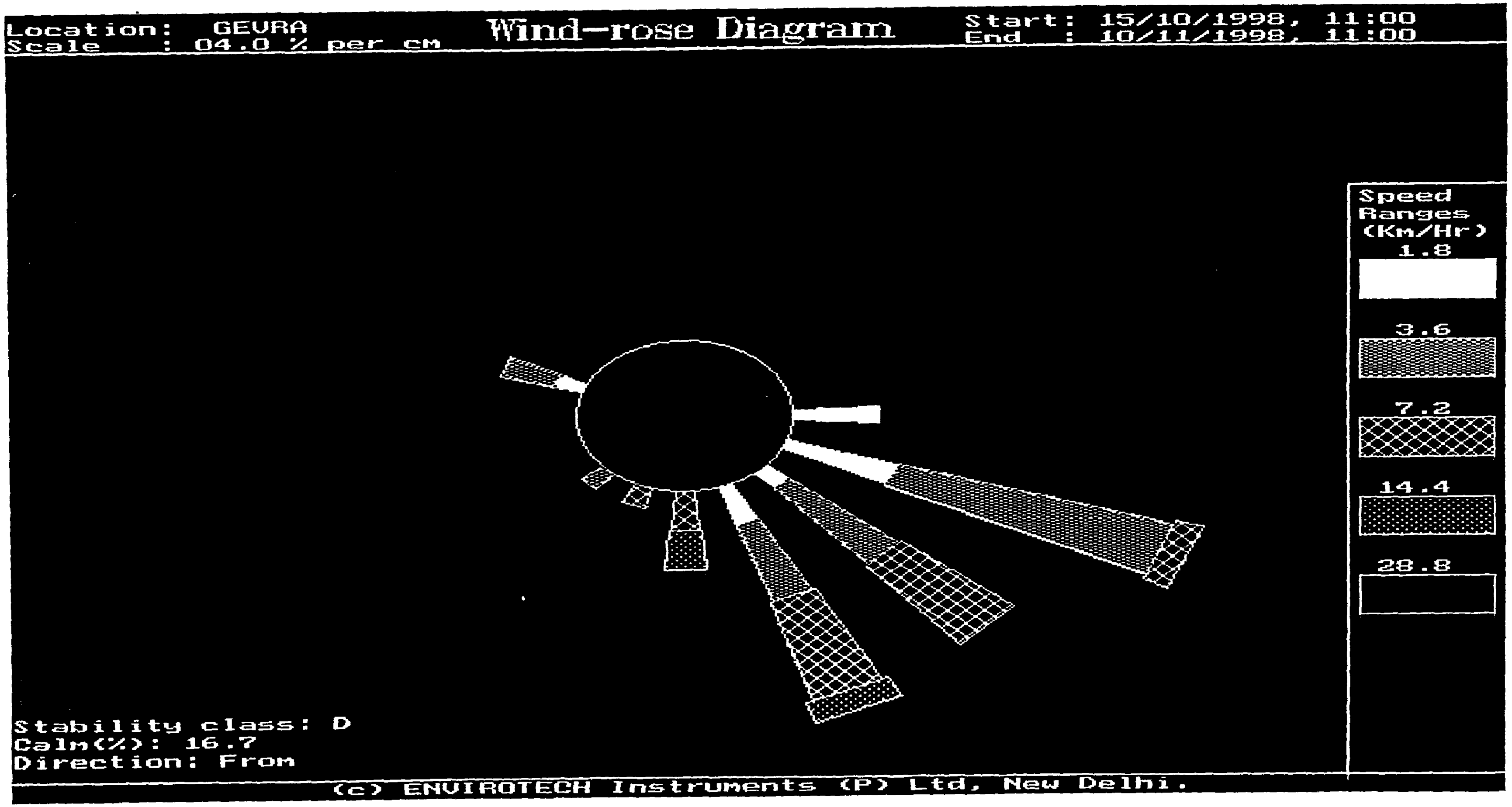
Stability class: B
Calm(%): 12.6
Direction: From

(c) ENVIROTECH Instruments (P) Ltd, New Delhi.

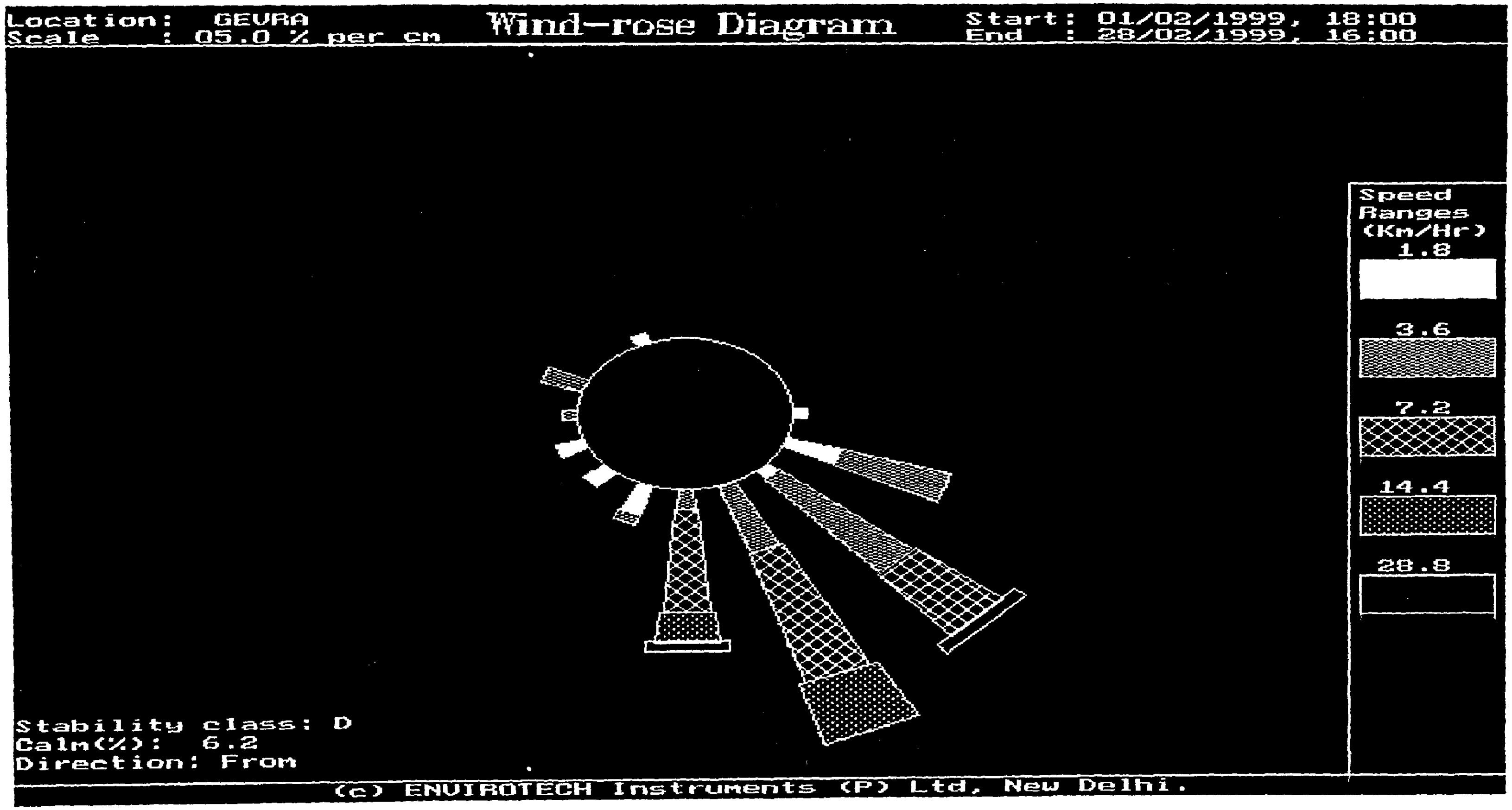
Wind rose for winter season



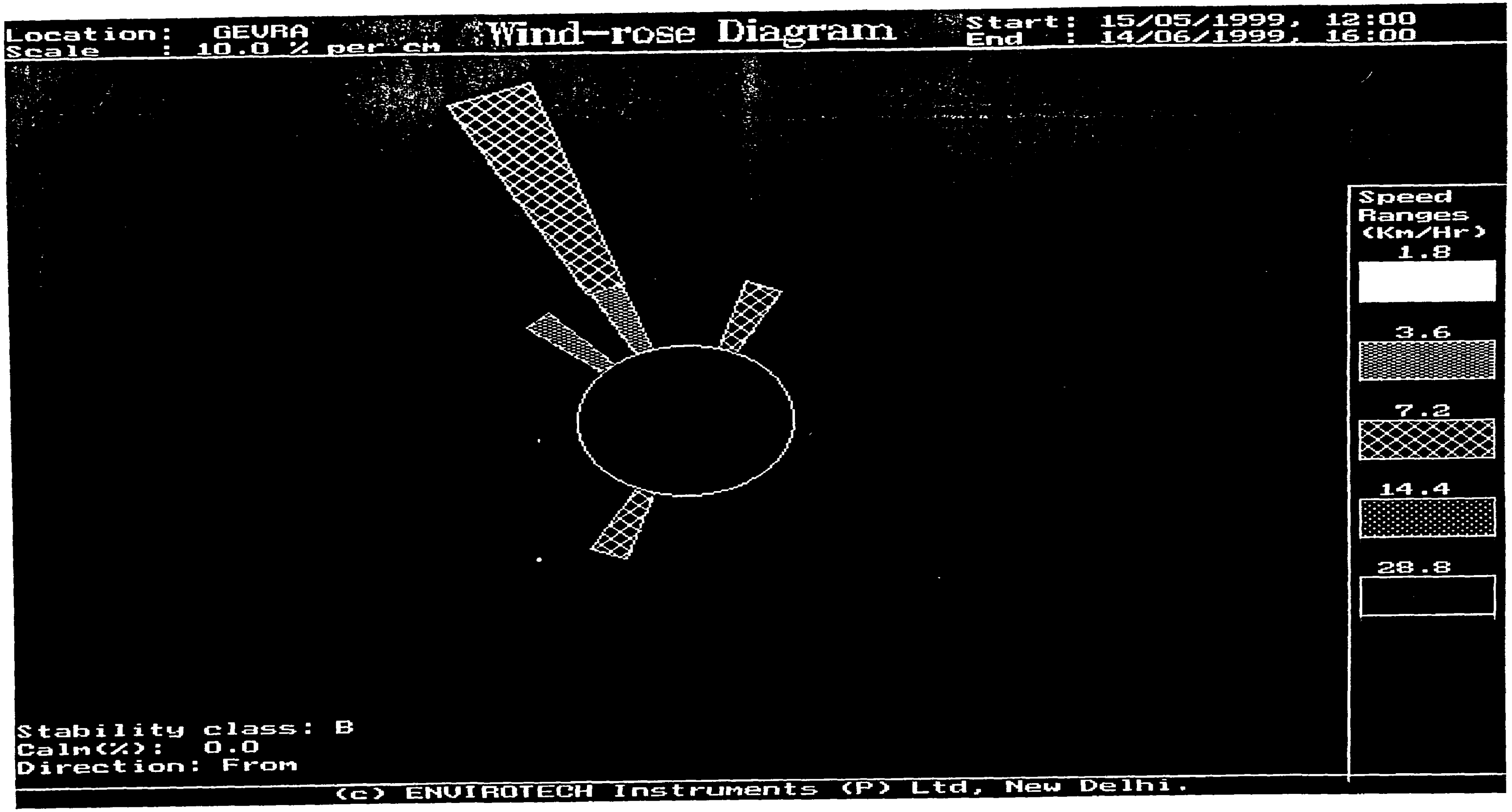
Windrose for post monsoon season



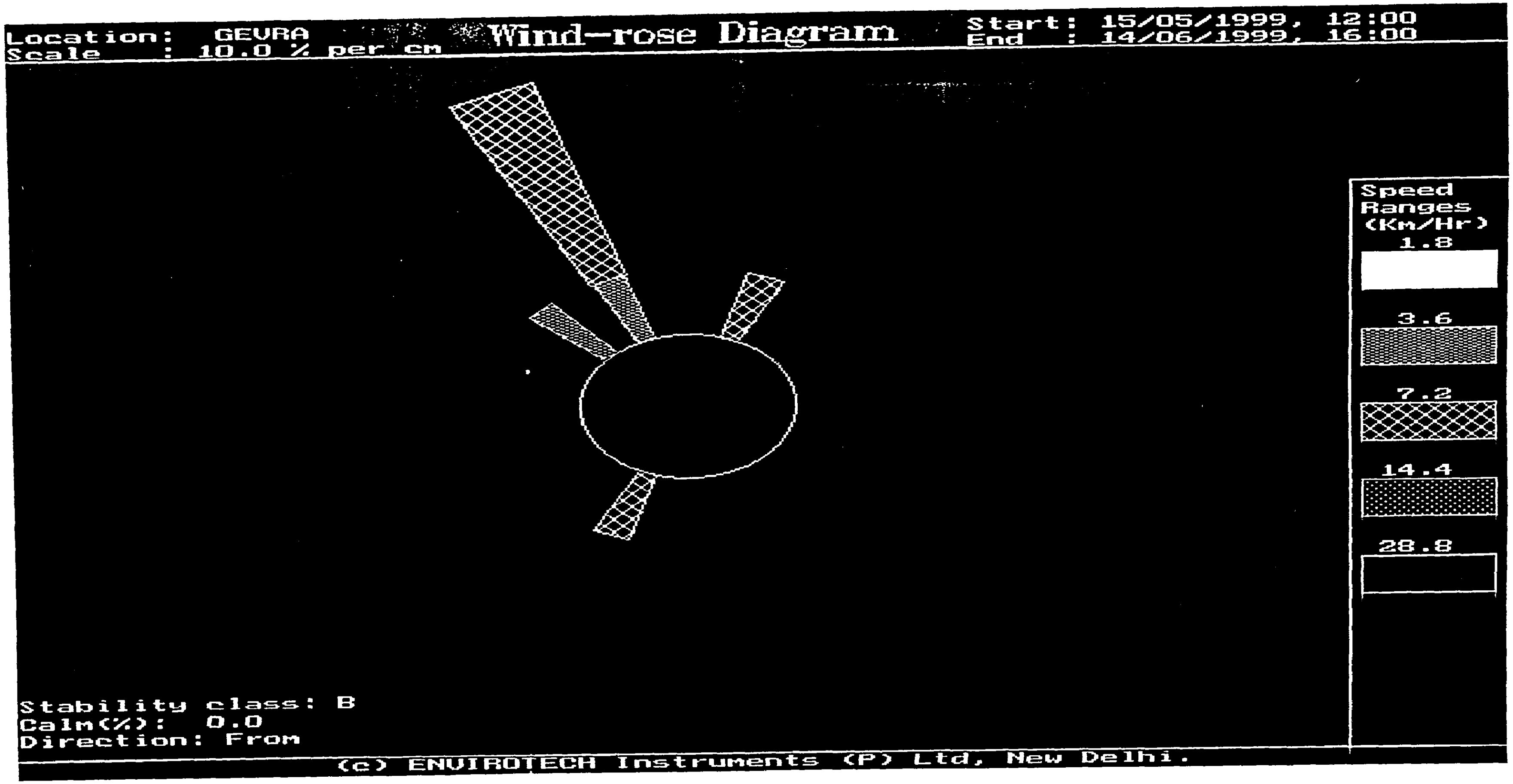
Wind rose for winter season

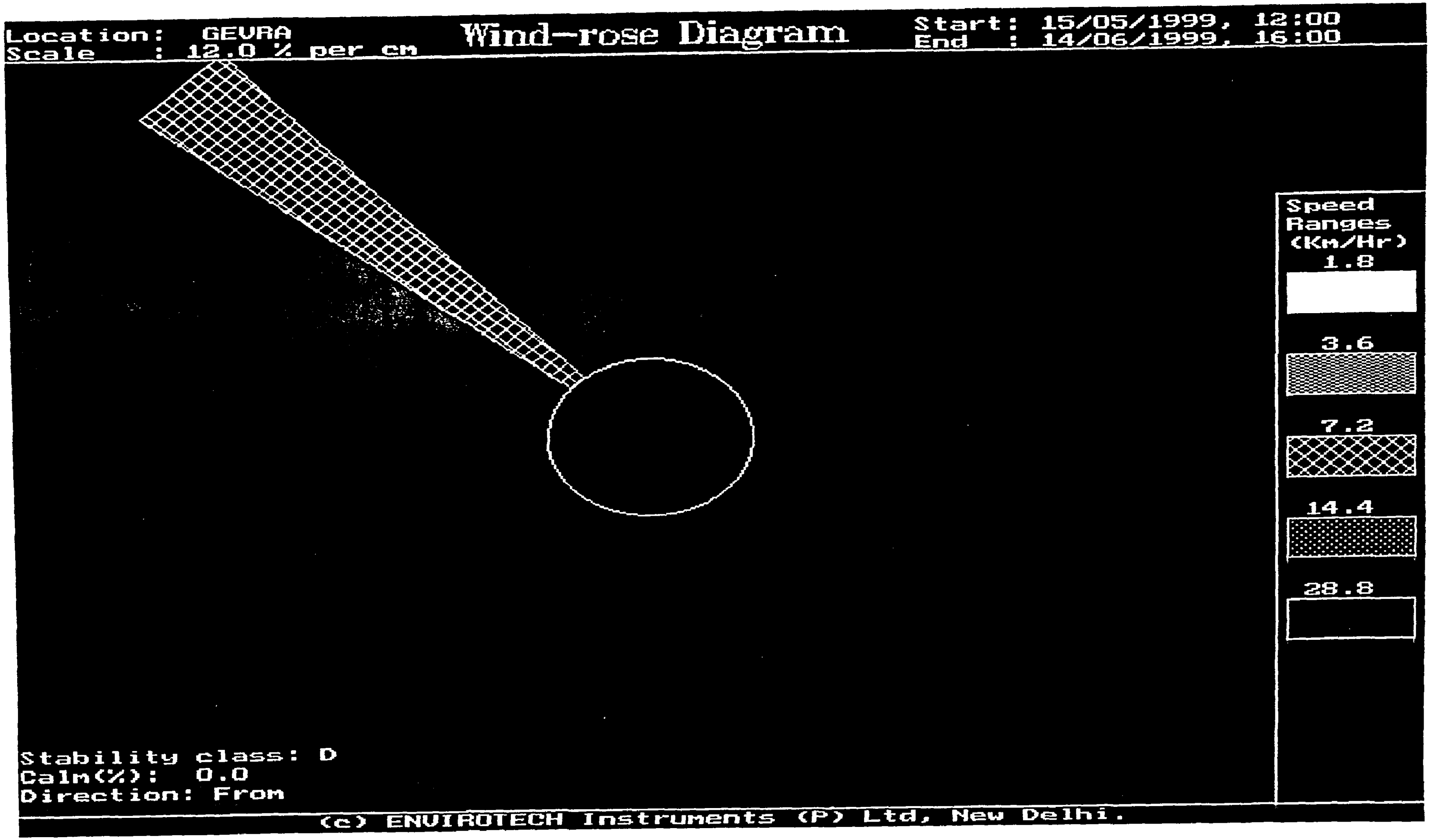


Wind rose for summer season



Wind rose for summer season





Location: GEVRA
Scale   : 12.0 % per cm

Wind-rose Diagram

Start: 15/05/1999, 12:00
End : 14/06/1999, 16:00

Stability class: D
Calm(%): 0.0
Direction: From

(c) ENVIROTECH Instruments (P) Ltd, New Delhi.

SPM AND RPM-10 DATA

Winter Season Monitoring, February 1999

Date	Station	HVS/RDS	$\mu g/m^3$
4 2 99	Non bira	HVS	105
6 2 99	Non bira	HVS	64
8 2 99	Non bira	HVS	79
10 2 99	Non bira	HVS	61
12 2.99	Non bira	HVS	71
15 2 99	Non bira	HVS	41
19 2.99	Non bira	HVS	89
22.2 99	Non bira	HVS	73
24 2 99	Non bira	HVS	109
25 2 99	Non bira	HVS	90
4 2.99	Non bira	RDS	46
8.2 99	Non bira	RDS	44
12 2 99	Non bira	RDS	
17 2 99	Non bira	RDS	35
24 2 99	Non bira	RDS	81
4 2 99	Gevra 1	HVS	873
4 2 99	Gevra 3	HVS	457
6 2 99	Gevra 1	HVS	511
6 2.99	Gevra 2	HVS	834
6 2 99	Gevra 3	HVS	250
8 2 99	Gevra 1	HVS	324
8 2 99	Gevra 2	HVS	1056
10 2 99	Gevra 1	HVS	229
12 2 99	Gevra 1	HVS	336
12 2 99	Gevra 2	HVS	1740
12 2 99	Gevra 3	HVS	227
15 2 99	Gevra 1	HVS	1290
15 2 99	Gevra 2	HVS	498
15 2 99	Gevra 3	HVS	1347
17 2 99	Gevra 1	HVS	714
17 2 99	Gevra 2	HVS	1576
17 2 99	Gevra 3	HVS	692
19 2 99	Gevra 1	HVS	190
19.2 99	Gevra 2	HVS	1773
19 2 99	Gevra 3	HVS	936
22.2.99	G. Mines 1	HVS	725
22 2.99	G. Mines 2	HVS	1406
22.2.99	G. Mines 3	HVS	1589
24 2.99	G. Mines 1	HVS	978
24.2.99	G. Mines 2	HVS	1566
24.2.99	G. Mines 3	HVS	548
25.2.99	G. Mines 1	HVS	852
25.2.99	G. Mines 2	HVS	1776
25.2.99	G. Mines 3	HVS	610
4.2.99	Gevra 1	RDS	377
4.2.99	Gevra 2	RDS	912
4 2.99	Gevra 3	RDS	449
8.2.99	Gevra 1	RDS	503
8.2.99	Gevra 2	RDS	486
8.2.99	Gevra 3	RDS	65

Date	Station	HVS/RDS	$\mu g/m^3$
12.2.99	Gevra 1	RDS	136
12.2.99	Gevra 2	RDS	365
12.2.99	Gevra 3	RDS	157
17.2.99	Gevra 1	RDS	593
17.2.99	Gevra 3	RDS	918
24.2.99	G. Mines 1	RDS	382
24.2.99	G. Mines 2	RDS	460
24.2.99	G. Mines 3	RDS	236
4.2.99	A. Nagar	HVS	
6.2.99	A. Nagar	HVS	152
8.2.99	A. Nagar	HVS	160
10.2.99	A. Nagar	HVS	174
15.2.99	A. Nagar	HVS	156
17.2.99	A. Nagar	HVS	202
22.2.99	A. Nagar	HVS	179
24.2.99	A. Nagar	HVS	203
25.2.99	A. Nagar	HVS	230
4.2.99	A. Nagar	RDS	158
8.2.99	A. Nagar	RDS	153
12.2.99	A. Nagar	RDS	81
17.2.99	A. Nagar	RDS	135
24.2.99	A. Nagar	RDS	147
4.2.99	GSI Camp	HVS	328
6.2.99	GSI Camp	HVS	186
8.2.99	GSI Camp	HVS	201
10.2.99	GSI Camp	HVS	205
12.2.99	GSI Camp	HVS	164
17.2.99	GSI Camp	HVS	139
19.2.99	GSI Camp	HVS	380
22.2.99	GSI Camp	HVS	397
24.2.99	GSI Camp	HVS	406
25.2.99	GSI Camp	HVS	334
4.2.99	GSI Camp	RDS	105
8.2.99	GSI Camp	RDS	
12.2.99	GSI Camp	RDS	113
17.2.99	GSI Camp	RDS	152
24.2.99	GSI Camp	RDS	143
4.2.99	Korba	HVS	375
6.2.99	Korba	HVS	403
8.2.99	Korba	HVS	478
10.2.99	Korba	HVS	467
12.2.99	Korba	HVS	352
15.2.99	Korba	HVS	530
17.2.99	Korba	HVS	622
19.2.99	Korba	HVS	597
22.2.99	Korba	HVS	463
24.2.99	Korba	HVS	627
25.2.99	Korba	HVS	592
4.2.99	Korba	RDS	164
8.2.99	Korba	RDS	144
12.2.99	Korba	RDS	186
17.2.99	Korba	RDS	238

Date	Station	HVS/RDS	$\mu g/m^3$
24 2 99	Korba	RDS	288
4 2 99	Manikpur	HVS	619
6 2 99	Manikpur	HVS	230
8 2.99	Manikpur	HVS	196
10 2.99	Manikpur	HVS	249
15 2.99	Manikpur	HVS	227
17 2.99	Manikpur	HVS	232
19 2 99	Manikpur	HVS	222
22.2.99	Manikpur	HVS	234
24.2.99	Manikpur	HVS	263
25 2.99	Manikpur	HVS	275
4.2.99	Manikpur	RDS	170
8.2.99	Manikpur	RDS	
12.2.99	Manikpur	RDS	
17.2.99	Manikpur	RDS	118
24.2.99	Manikpur	RDS	137
16.2.99	Urja Nagar	HVS	125
18.2 99	Urja Nagar	HVS	87
20.2.99	Urja Nagar 1	HVS	127
20.2 99	Urja Nagar 2	HVS	154
20.2.99	Urja Nagar 3	HVS	71

Summer Season Monitoring, May - June 1998

Date	Station	HVS/RDS	$\mu g/m^3$
22.5.99	Non birra	HVS	66
24.5.99	Non birra	HVS	62
26.5.99	Non birra	HVS	128
28.5.99	Non birra	HVS	72
31.5.99	Non birra	HVS	91
2.6.99	Non birra	HVS	77
4.6.99	Non birra	HVS	181
9.6.99	Non birra	HVS	116
11.6.99	Non birra	HVS	108
24.5.99	Non birra	RDS	39
28.5.99	Non birra	RDS	114
2.6.99	Non birra	RDS	49
9.6.99	Non birra	RDS	44
22.5.99	G. Mines (1	HVS	490
22.5.99	G. Mines (2	HVS	1017
22.5.99	G. Mines (3	HVS	633
24.5.99	G. Mines (1	HVS	264
24 5.99	G. Mines (2	HVS	439
26.5.99	G. Mines (1	HVS	379
26.5.99	G. Mines (2	HVS	1848
26.5.99	G. Mines (3	HVS	1003
28.5.99	G. Mines (1	HVS	353
28.5 99	G. Mines (2	HVS	473
31.5.99	G. Mines (1	HVS	1336
31.5.99	G. Mines (2	HVS	1848
31 5 99	G. Mines (3	HVS	2026
2.6.99	G. Mines (1	HVS	986
2.6.99	G. Mines (2	HVS	697
2.6.99	G. Mines (3	HVS	1419
4.6.99	G. Mines (1	HVS	842
4.6.99	G. Mines (2	HVS	1185
7 6 99	G. Mines (1	HVS	1673
9.6.99	G. Mines (1	HVS	2057
9.6.99	G. Mines (2	HVS	2659
9.6 99	G. Mines (3	HVS	2889
11 6.99	G. Mines (1	HVS	208
24.5.99	G. Mines (1	RDS	124
24.5.99	G. Mines (2	RDS	219
24.5 99	G. Mines (3	RDS	109
28.5 99	G. Mines (1	RDS	1077
28.5.99	G. Mines (2	RDS	473
28.5 99	G. Mines (3	RDS	1072
2 6.99	G. Mines (1	RDS	609
2.6.99	G. Mines (2	RDS	685
2.6.99	G. Mines (3	RDS	222
9.6.99	G. Mines (1	RDS	596
9.6 99	G. Mines (2	RDS	936
22.5 99	A. Nagar	HVS	244
26.5.99	A. Nagar	HVS	236
28.5.99	A. Nagar	HVS	532
31.5.99	A. Nagar	HVS	149
2.6.99	A. Nagar	HVS	173
4.6.99	A. Nagar	HVS	181
7.6.99	A. Nagar	HVS	361
9.6.99	A. Nagar	HVS	398
11.6.99	A. Nagar	HVS	99

Date	Station	HVS/RDS	$\mu g/m^3$
24.5.99	A. Nagar	RDS	107
28.5.99	A. Nagar	RDS	53
	A. Nagar	RDS	117
9.6.99	A. Nagar	RDS	149
22.5.99	G.S.I.	HVS	282
24.5.99	G.S.I.	HVS	172
26.5.99	G.S.I.	HVS	345
28.5.99	G.S.I.	HVS	254
31.5.99	G.S.I.	HVS	289
2.6.99	G.S.I.	HVS	244
4.6.99	G.S.I.	HVS	158
7.6.99	G.S.I.	HVS	456
9.6.99	G.S.I.	HVS	310
24.5.99	G.S.I.	RDS	81
28.5.99	G.S.I.	RDS	145
2.6.99	G.S.I.	RDS	85
9.6.99	G.S.I.	RDS	93
22.5.99	Korba	HVS	313
24.5.99	Korba	HVS	386
26.5.99	Korba	HVS	369
28.5.99	Korba	HVS	455
31.5.99	Korba	HVS	555
2.6.99	Korba	HVS	357
4.6.99	Korba	HVS	354
7.6.99	Korba	HVS	569
9.6.99	Korba	HVS	320
11.6.99	Korba	HVS	141
24.5.99	Korba	RDS	120
28.5.99	Korba	RDS	88
2.6.99	Korba	RDS	33
9.6.99	Korba	RDS	132
22.5.99	Manikpur	HVS	204
24.5.99	Manikpur	HVS	150
26.5.99	Manikpur	HVS	177
28.5.99	Manikpur	HVS	204
31.5.99	Manikpur	HVS	349
2.6.99	Manikpur	HVS	265
4.6.99	Manikpur	HVS	238
7.6.99	Manikpur	HVS	367
9.6.99	Manikpur	HVS	169
11.6.99	Manikpur	HVS	102
24.5.99	Manikpur	RDS	51
28.5.99	Manikpur	RDS	63
2.6.99	Manikpur	RDS	107
9.6.99	Manikpur	RDS	134
7.6.99	U. Nagar	HVS	382
9.6.99	U. Nagar	HVS	256
11.6.99	U. Nagar	HVS	182

Post Monsoon Season Monitoring, October 1998

Date	Station	HVS/RDS	$\mu g/m^3$
20 10 98	Non birra	HVS	127
21 10 98	Non birra	HVS	61
23 10 98	Non birra	HVS	51
24 10 98	Non birra	HVS	37
26 10 98	Non birra	HVS	134
27 10 98	Non birra	HVS	76
29.10.98	Non birra	HVS	90
2.11 98	Non birra	HVS	91
4 11 98	Non birra	HVS	147
6.11.98	Non birra	HVS	90
20.10.98	Non birra	RDS	42
21.10.98	Non birra	RDS	28
26.10.98	Non birra	RDS	42
29.10.98	Non birra	RDS	45
30.10.98	Non birra	RDS	
2.11 98	Non birra	RDS	45
4.11.98	Non birra	RDS	89
20.10.98	G. Mines	HVS	175
21.10.98	G. Mines	HVS	286
23.10.98	G. Mines 1	HVS	348
23.10.98	G. Mines 2	HVS	
23.10.98	G. Mines 3	HVS	
24.10 98	G. Mines 1	HVS	112
24.10.98	G. Mines 2	HVS	566
26.10.98	G. Mines 1	HVS	2214
26 10.98	G. Mines 2	HVS	364
26 10.98	G. Mines 3	HVS	559
27.10.98	G. Mines 1	HVS	809
27 10.98	G. Mines 2	HVS	2116
27.10.98	G. Mines 3	HVS	1974
29.10.98	G. Mines 1	HVS	696
29.10 98	G. Mines 2	HVS	1254
29.10.98	G. Mines 3	HVS	
30.10.98	G. Mines 1	HVS	886
30.10.98	G. Mines 2	HVS	346
30.10.98	G. Mines 3	HVS	114
2.11.98	G. Mines 1	HVS	255
2 11.98	G. Mines 2	HVS	398
2 11.98	G. Mines 3	HVS	712
4.11.98	G. Mines 1	HVS	362
4.11.98	G. Mines 2	HVS	1760
4.11.98	G. Mines 3	HVS	831
6.11.98	G. Mines 1	HVS	621
6.11.98	G. Mines 2	HVS	1257
6.11.98	G. Mines 3	HVS	311
20.10.98	G. Mines	RDS	71
21.10.98	G. Mines	RDS	156
24.10.98	G. Mines 3	RDS	430
26.10.98	G. Mines	RDS	349
29.10.98	G. Mines 1	RDS	539

Date	Station	HVS/RDS	$\mu g/m^3$
29.10.98	G. Mines 2	RDS	818
29.10.98	G. Mines 3	RDS	566
30.10.98	G. Mines 1	RDS	587
30.10.98	G. Mines 2	RDS	277
30.10.98	G. Mines 3	RDS	130
2.11.98	G. Mines	RDS	223
4.11.98	G. Mines	RDS	215
20.10.98	Adarsh Nagar	HVS	93
21.10.98	A. Nagar	HVS	48
23.10.98	A. Nagar	HVS	119
24.10.98	A. Nagar	HVS	86
26.10.98	A. Nagar 1	HVS	
26.10.98	A. Nagar 2	HVS	
26.10.98	A. Nagar 3	HVS	
27.10.98	A. Nagar 1	HVS	493
27.10.98	A. Nagar 2	HVS	162
27.10.98	A. Nagar 3	HVS	
29.10.98	A. Nagar 1	HVS	331
29.10.98	A. Nagar 2	HVS	406
29.10.98	A. Nagar 3	HVS	
30.10.98	A. Nagar 1	HVS	197
30.10.98	A. Nagar 2	HVS	167
30.10.98	A. Nagar 3	HVS	323
2.11.98	A. Nagar	HVS	215
4.11.98	A. Nagar	HVS	76
6.11.98	A. Nagar	HVS	96
20.10.98	Adarsh Nagar	RDS	43
21.10.98	A. Nagar	RDS	42
26.10.98	A. Nagar	RDS	74
29.10.98	A. Nagar 1	RDS	77
29.10.98	A. Nagar 2	RDS	179
29.10.98	A. Nagar 3	RDS	
2.11.98	A. Nagar	RDS	61
4.11.98	A. Nagar	RDS	54
20.10.98	GSI Camp	HVS	51
21.10.98	GSI Camp	HVS	58
23.10.98	GSI Camp	HVS	173
24.10.98	GSI Camp	HVS	104
26.10.98	GSI Camp	HVS	107
27.10.98	GSI Camp	HVS	182
29.10.98	GSI Camp	HVS	195
30.10.98	GSI Camp	HVS	159
2.11.98	GSI Camp	HVS	145
4.11.98	GSI Camp	HVS	174
20.10.98	GSI Camp	RDS	
21.10.98	GSI Camp	RDS	39
26.10.98	GSI Camp	RDS	102
29.10.98	GSI Camp	RDS	
2.11.98	GSI Camp	RDS	54
4.11.98	GSI Camp	RDS	110
20.10.98	Korba Town	HVS	160
21.10.98	Korba Town	HVS	373

Date	Station	HVS/RDS	$\mu g/m^3$
23.10.98	Korba Town	HVS	217
24.10.98	Korba Town	HVS	392
26.10.98	Korba Town	HVS	321
27.10.98	Korba Town	HVS	285
29.10.98	Korba Town	HVS	320
20.10.98	Korba Town	RDS	
21.10.98	Korba Town	RDS	102
26.10.98	Korba Town	RDS	145
29.10.98	Korba Town	RDS	155
21 10.98	Manikpur	HVS	185
23.10.98	Manikpur	HVS	178
24.10.98	Manikpur	HVS	139
26.10.98	Manikpur 1	HVS	197
26.10.98	Manikpur 2	HVS	213
26.10.98	Manikpur 3	HVS	295
27.10.98	Manikpur 1	HVS	593
27.10.98	Manikpur 2	HVS	91
27.10.98	Manikpur 3	HVS	230
29.10.98	Manikpur 1	HVS	
29.10.98	Manikpur 2	HVS	713
29.10.98	Manikpur 3	HVS	104
30.10.98	Manikpur 1	HVS	77
30.10.98	Manikpur 2	HVS	134
30.10.98	Manikpur 3	HVS	90
2.11.98	Manikpur	HVS	82
4.11.98	Manikpur	HVS	97
6.11.98	Manikpur	HVS	91
21.10.98	Manikpur	RDS	82
23.10.98	Manikpur	RDS	75
26.10.98	Manikpur	RDS	82
29.10.98	Manikpur 1	RDS	97
29.10.98	Manikpur 2	RDS	128
29.10.98	Manikpur 3	RDS	69
2.11.98	Manikpur	RDS	38
4.11.98	Manikpur	RDS	59

Monsoon Season Monitoring, August - September 1999

Date	Station	HVS / RDS	$\mu g/m^3$
14.8.99	Nonbirra	HVS	77
16.8.99	Nonbirra	HVS	55
18.8.99	Nonbirra	HVS	48
20.8.99	Nonbirra	HVS	22
23.8.99	Nonbirra	HVS	46
25.8.99	Nonbirra	HVS	44
16.8.99	Nonbirra	RDS	32
18.8.99	Nonbirra	RDS	26
23.8.99	* Nonbirra	RDS	27
14.8.99	Gevra	HVS	152
16.8.99	Gevra	HVS	264
18.8.99	Gevra	HVS	119
20.8.99	Gevra	HVS	47
23.8.99	Gevra	HVS	685
25.8.99	Gevra	HVS	490
16.8.99	Gevra	RDS	94
18.8.99	Gevra	RDS	52
23.8.99	Gevra	RDS	340
14.8.99	A Nagar	HVS	109
16.8.99	A Nagar	HVS	92
18.8.99	A Nagar	HVS	80
20.8.99	A Nagar	HVS	87
23.8.99	A Nagar	HVS	106
25.8.99	A Nagar	HVS	92
16.8.99	A Nagar	RDS	66
18.8.99	A Nagar	RDS	30
23.8.99	A Nagar	RDS	48
14.8.99	GSI	HVS	147
16.8.99	GSI	HVS	181
18.8.99	GSI	HVS	94
20.8.99	GSI	HVS	56
23.8.99	GSI	HVS	94
25.8.99	GSI	HVS	
16.8.99	GSI	RDS	114
18.8.99	GSI	RDS	68
23.8.99	GSI	RDS	63
14.8.99	Korba	HVS	390
16.8.99	Korba	HVS	253
18.8.99	Korba	HVS	404
16.8.99	Korba	RDS	131
18.8.99	Korba	RDS	157
25.8.99	Manikpur	HVS	126
14.8.99	Manikpur	HVS	126
16.8.99	Manikpur	HVS	156
18.8.99	Manikpur	HVS	134
20.8.99	Manikpur	HVS	54
23.8.99	Manikpur	HVS	176
16.8.99	Manikpur	RDS	57
18.8.99	Manikpur	RDS	31
23.8.99	* Manikpur	RDS	82
21.8.99	A Nagar Road Side	HVS	153
23.8.99	A Nagar Road Side	HVS	262
24.8.99	Laxman mine	HVS	285

HEAVY METAL DATA

Post Monsoon Season

Date	Station	Fe(μg/m^3)	Cu(μg/m^3)	Si(μg/m^3)	Pb(μg/m^3)	Mn(μg/m^3)	Cd(μg/m^3)	Ni(μg/m^3)	Al(μg/m^3)	Cr(μg/m^3)	Zn(μg/m^3)	Hg(μg/m^3)	As(μg/m^3)
23.10.98	A Nagar	2.6518	1.5337	0.4652	0.0952	0.0505	0.0000	0.0506	2.3806	0.1706	0.2441	0.0022	0.0497
24.10.98	A Nagar	1 6132	2.8107	0.7239	0.2748	0.0724	0.0000	0.1637	2.1846	0.2950	0.2979	0.0000	0.0007
27.10.98	A Nagar	8.0283	8.8957	12.3572	0.3118	0.1821	0.0000	0.6721	3.2774	1.1918	1.1619	0.0000	0.0000
29.10.98	A Nagar	1.9652	3.0067	2.1994	0.1542	0.0425	0.0000	0.2899	0.7719	0.5371	1.7210	0.0096	0.0003
30.10.98	A Nagar	1.2055	2.7068	2.1367	0.1589	0.0410	0.0000	0.1956	1.2033	0.3315	0.3115	0.0000	0.0002
2 11 98	A Nagar	1.0192	8.3186	0.7867	0.0406	0.0202	0.0000	0.0910	0.1862	0.2613	0.3028	0.0001	0.0006
4 11.98	A Nagar	0.6457	0.8505	1.0171	0.0667	0.0209	0.0000	0.1060	0.3775	0.1972	0.0706	0.0000	0.0000
6.11 98	A Nagar	0.7030	0.2609	0.8841	0.7416	0.0508	0.0000	0.0128	1.0867	0.1473	0.0148	0.0000	0.0014
21.10.98	A.Nagar	0.9512	0.7284	0.4618	0.0411	0.0238	0.0000	0.0436	1.0530	0.0616	0.1851	0.0017	0.0000
2.11.98	A.Nagar	0.6353	1.0514	0.8837	0.2040	0.0164	0.0000	0.0958	1.1650	0.2351	0.0400	0.0000	0.0000
23.10.98	G mines	1.2343	1.7398	0.4263	0.0399	0.0421	0.0000	0.1261	1.2960	0.1397	0.1754	0.0000	0.0966
24.10.98	G mines	2.2063	0.7585	0.2251	0.0547	0.0598	0.0000	0.1050	2.7806	0.2082	0.0876	0.0000	0.0032
26.10.98	G mines	10.7885	1.9435	0.8667	0.0739	0.3800	0.0000	0.1964	11.2680	0.2833	0.1053	0.0000	0.0102
27.10.98	G mines	9.4151	2.9914	1.0726	0.1141	0.3023	0.0000	0.2434	7.4032	0.4050	0.3543	0.0000	0.0076
29.10.98	G mines												
30.10.98	G mines	3.2920	1.6218	2.7281	0.8107	0.0662	0.0000	0.2032	3.0657	0.3642	0.0925	0.0223	0.0042
2.11.98	G mines	63.7127	0.5664	2.0685	0.0664	0.1259	0.0000	0.2162	5.1472	0.3460	0.2041	0.0000	0.0027
2.11.98	G mines	6.3262	3.7439	4.8972	0.2859	0.2173	0.0000	0.4417	6.1382	1.1187	0.1006	0.1072	0.0000
4.11.98	G mines	2.1046	1.1825	2.7832	0.1544	0.0633	0.0000	0.2135	2.0846	0.3532	0.1287	0.0000	0.0000
6.11.98	G mines	8.1778	1.3440	3.8723	0.0488	0.2680	0.0000	0.0552	8.4488	0.6661	0.1912	0.0000	0.0000
21.10.98	G.mines	4.6702	0.7362	0.3649	0.0531	0.0773	0.0000	0.0656	0.0000	0.0953	0.1500	0.0000	0.0000
21.10.98	G. S. I.	0.9674	0.4685	0.2378	0.0227	0.0277	0.0000	0.0362	1.0862	0.0736	0.0387	0.0000	0.0004
23.10.98	G. S. I.	0.6758	0.6818	0.1274	0.0160	0.0225	0.0000	0.0254	0.6076	0.0604	0.1367	0.0000	0.0170
24.10.98	G. S. I.	0.9486	2.2212	0.1041	0.0303	0.0259	0.0006	0.0385	0.2191	0.0949	0.0457	0.0025	0.0011
26.10.98	G. S. I.	1.3854	0.8856	0.3078	0.0316	0.0288	0.0000	0.0404	0.5501	0.0678	0.0590	0.0007	0.0016
27.10.98	G. S. I.	1.3108	1.3924	1.7650	0.0274	0.0330	0.0000	0.0958	1.6908	0.1364	0.0741	0.0015	0.0000
29.10.98	G. S. I.	1.6374	1.4120	2.0648	0.0393	0.0449	0.0000	0.1683	0.5644	0.2063	0.6362	0.0014	0.0006
30.10.98	G. S. I.	1.6279	0.0819	0.9741	0.0349	0.0376	0.0000	0.1222	0.0000	0.2803	0.5459	0.0038	0.0010
2.11.98	G. S. I.	0.8491	1.6720	1.0041	0.2038	0.0196	0.0000	0.1094	0.3888	0.2125	0.1661	0.0099	0.0010
2.11.98	G. S. I.	0.6799	0.7612	1.0284	0.0893	0.0004	0.0000	0.0925	1.3158	0.1972	0.0599	0.0057	0.0000
4.11.98	G. S. I.	0.9037	0.8432	1.2490	0.0667	0.0289	0.0000	0.1004	0.3215	0.1697	0.1201	0.0067	0.0298
21.10.98	Korba town	1.7613	0.2287	0.4092	0.0422	0.0539	0.0015	0.0265	1.8637	0.0388	0.1842	0.0000	0.0012
23.10.98	Korba town	1.6359	0.2494	0.1898	0.0594	0.0475	0.0000	0.1308	1.8557	0.0596	0.0135	0.0301	0.0371
24.10.98	Korba town	2.8987	0.3790	0.4085	0.2208	0.1006	0.0005	0.0528	4.1065	0.1187	0.0539	0.0008	0.0053

Date	Station	Fe($\mu g/m^3$)	Cu($\mu g/m^3$)	Si($\mu g/m^3$)	Pb($\mu g/m^3$)	Mn($\mu g/m^3$)	Cd($\mu g/m^3$)	Ni($\mu g/m^3$)	Al($\mu g/m^3$)	Cr($\mu g/m^3$)	Zn($\mu g/m^3$)	Hg($\mu g/m^3$)	As($\mu g/m^3$)
26.10.98	Korba town	1.8356	0.9518	0.4900	0.0966	0.1127	0.0000	0.0591	3.4999	0.0967	0.0978	0.0022	0.0026
27.10.98	Korba town	1.8983	0.3057	0.6033	0.1777	0.0719	0.0000	0.0686	3.0537	0.0981	0.2240	0.0000	0.0000
29.10.98	Korba town	1.8087	0.4084	0.7872	0.0262	0.0423	0.0000	0.0677	1.6262	0.1009	0.0640	0.0004	0.0004
23.10.98	Manikpur	3.3681	2.8132	0.4657	0.2137	0.0561	0.0011	0.1937	1.2941	0.3224	0.9000	0.0105	0.0000
24.10.98	Manikpur	1.2573	1.9796	0.2064	0.0503	0.0233	0.0003	0.0580	0.1242	0.1401	0.3860	0.0002	0.0003
27.10.98	Manikpur	4.0925	4.4881	4.9562	1.1697	0.1592	0.0000	0.5736	4.0105	0.7962	2.9017	0.0112	0.0011
30.10.98	Manikpur	2.1418	1.4937	3.4092	0.3376	0.0686	0.0000	0.3647	4.0498	0.5903	0.1375	0.0000	0.0030
2.11.98	Manikpur	0.4999	0.7596	0.6932	1.0905	0.0143	0.0000	0.0643	1.2217	0.1461	0.0251	0.0000	0.0028
2.11.98	Manikpur	0.3716	0.5114	0.9669	1.5264	0.0157	0.0000	0.0866	1.0657	0.1519	0.0094	0.0441	0.0080
4.11.98	Manikpur	0.9407	0.5924	1.7793	0.9016	0.0222	0.0000	0.0088	1.0811	0.1846	0.0646	0.0014	0.0045
6.11.98	Manikpur	0.9288	1.2451	0.8902	0.0340	0.0279	0.0106	0.0424	0.2239	0.2153	0.1850	0.0000	0.0000
23.10.98	Non birra	0.8224	0.3806	0.1463	0.0146	0.0217	0.0000	0.0357	0.1597	0.0683	0.2592	0.0000	0.0000
21.10.98	Non birra	4.3935	5.0493	2.5694	1.2486	0.1894	0.0000	0.6542	6.7971	0.8921	1.0812	0.0220	0.0000
24.10.98	Non birra	0.4127	0.7841	0.1579	0.0326	0.0216	0.0000	0.0606	0.7241	0.0806	0.0610	0.0000	0.0012
26.10.98	Non birra	0.8475	1.1721	0.1450	0.0287	0.0262	0.0000	0.0450	0.2949	0.0688	0.0605	0.0000	0.0025
27.10.98	Non birra	0.8386	1.0766	0.1861	0.0332	0.0269	0.0000	0.0507	0.3136	0.0878	0.0651	0.0024	0.0016
29.10.98	Non birra	0.6780	0.4332	2.2368	0.1182	0.0184	0.0000	0.0533	0.3670	0.0874	0.0647	0.0000	0.0001
2.11.98	Non birra	0.3773	4.3069	0.6251	0.1034	0.0102	0.0000	0.0776	0.1382	0.1238	0.1014	0.0000	0.0009
2.11.98	Non birra	0.3721	2.4647	0.8434	0.0585	0.0171	0.0000	0.1103	0.4236	0.1690	0.0633	0.0000	0.0021
4.11.98	Non birra	0.5060	0.9398	1.1527	0.1201	0.0214	0.0000	0.0967	0.4457	0.1545	0.0004	0.0000	0.0000
6.11.98	Non birra	0.6636	1.5311	0.9077	0.0466	0.0233	0.0000	0.0143	0.1660	0.1245	0.0174	0.0004	0.0000

Winter Season

Date	Station	Fe($\mu g/m^3$)	Cu($\mu g/m^3$)	si($\mu g/m^3$)	Pb($\mu g/m^3$)	Mn($\mu g/m^3$)	Cd($\mu g/m^3$)	Ni($\mu g/m^3$)	Al($\mu g/m^3$)	Cr($\mu g/m^3$)	Zn($\mu g/m^3$)	Hg($\mu g/m^3$)	As($\mu g/m^3$)
6.2.99	Non bira	0 8269	0.0035	0.4735	0.0759	0.0083	0.0295	0.0106	1.1277	0.0322	0.0459	0.0067	0.0075
8.2.99	Non bira	0 9553	0.0415	3.7038	0.0671	0.0127	0.0396	0.0087	1.9146	0.0299	0.2859	0.1293	0.0105
10.2.99	Non bira	0.4051	0.0134	1.0446	0.0989	0.0045	0.0060	0.0018	0.8754	0.1296	0.1558	0.1187	0.0088
12 2.99	Non bira	0 1148	0.2092	7.6324	0.2976	0.0009	0.0145	0.0004	0.4467	0.4302	0.1898	0.1340	0.0257
15.2.99	Non bira	3 5498	0.0908	4.5321	0.1192	0.0467	0.0015	0.0030	2.3887	0.3295	0.2773	0.0260	0.0067
17.2.99	Non bira	0.7170	0.0753	2.6778	0.0216	0.0077	0.0006	0.0001	0.3414	0.1147	0.1753	0.0531	0.0041
19.2.99	Non bira	1.5852	0.1189	7.2849	0.0545	0.0221	0.0010	0.0003	0.9442	0.2245	0.3175	0.0913	0.0070
22.2.99	Non bira	0.5810	0.0928	8.2538	0.0493	0.1186	0.0014	0.0001	0.4622	0.2196	0.1261	0.0164	0.0015
6.2.99	Gevra 1	3.9895	0.1570	2.9806	0.0743	0.0411	0.0401	0.0130	2.7167	0.1214	0.5465	0.1518	0.0084
8.2.99	Gevra 1	6.5349	0.0240	4.1206	0.1011	0.0631	0.0472	0.0226	4.6424	0.1331	0.4283	0.0257	0.0340
10.2.99	Gevra 1	1.8947	0.0610	1.1697	0.7359	0.0135	0.4403	0.0007	2.0808	0.3181	0.4942	0.0113	0.0210
12.2.99	Gevra 1	3.1048	0.1065	3.1221	0.1092	0.0262	0.0104	0.0004	2.3545	0.4566	0.5375	0.1159	0.0239
15.2.99	Gevra 1	6.0238	0.0795	21.5673	0.0959	0.0366	0.0041	0.0004	2.9572	0.5546	0.5671	0.0555	0.0168
17.2.99	Gevra 1	7.1391	0.0702	29.4401	0.1569	0.0434	0.0329	0.0008	3.9633	0.6204	0.6162	0.3220	0.0160
19.2.99	Gevra 1	6.4752	0.1968	18.1829	0.1370	0.2699	0.0037	0.0004	3.0104	0.8608	0.4485	0.2541	0.0187
22.2.99	G. Mines 1	2.5356	0.0835	6.1460	0.0674	0.1491	0.0023	0.0052	1.5531	0.2048	0.4848	0.0842	0.0072
24.2.99	G. Mines 1	8.3353	0.2915	24.4417	0.1463	0.4721	0.0048	0.0005	1.7756	0.7266	0.8103	0.0419	0.0147
6.2.99	A. Nagar	1.0812	0.0460	4.0348	0.0549	0.0138	0.0274	0.0072	1.2247	0.0194	0.2267	0.0212	0.0071
8.2.99	A. Nagar	1.1569	0.0481	0.4775	0.0264	0.0143	0.0103	0.0104	0.7696	0.0229	0.1565	0.0063	0.0045
10.2.99	A. Nagar	1.1837	0.0445	2.0139	0.0794	0.0111	0.0361	0.0097	1.1963	0.0916	0.1794	0.0136	0.0057
12.2.99	A. Nagar												
15.2.99	A. Nagar	2.4473	0.0540	3.9145	0.0967	0.0337	0.0148	0.0042	2.0558	0.2156	0.2461	0.1037	0.0066
17.2.99	A. Nagar	0.6542	0.1281	4.9152	0.0585	0.0071	0.0144	0.0001	0.4096	0.2301	0.3369	0.0974	0.0053
19.2.99	A. Nagar	0.6313	0.4155	6.8610	0.0483	0.0055	0.0041	0.0001	0.7854	0.2355	0.5248	0.0609	0.0083
22.2.99	A. Nagar	1.2194	0.1120	7.6223	0.0721	0.1237	0.0062	0.0001	0.6782	0.2231	0.1850	0.0485	0.0067
24.2.99	A. Nagar	1.0123	0.1251	7.4627	0.1145	0.1300	0.0514	0.0001	1.0521	0.2257	0.1918	0.0033	0.0040
6.2.99	GSI Camp	1.4054	0.0616	3.4442	0.0976	0.0171	0.0190	0.0003	1.2621	0.0856	0.2086	0.0789	0.0065
8.2.99	GSI Camp	1.4556	0.7616	4.3126	0.1515	0.0186	0.0633	0.0011	2.3410	0.0974	0.2094	0.0372	0.0070
10.2.99	GSI Camp	1.6401	0.0283	3.3273	0.0494	0.0154	0.0028	0.0003	1.1914	0.1356	0.2482	0.0370	0.0092
12.2.99	GSI Camp	1.2748	0.0825	1.4372	0.0525	0.0143	0.0029	0.1799	1.2431	0.1721	0.0868	0.0310	0.0093
14.2.99	GSI Camp	3.5205	0.1422	10.4402	0.3064	0.0480	0.0059	0.0012	3.1717	0.5682	0.4886	0.3210	0.0271
17.2.99	GSI Camp	1.1431	0.0980	4.7287	0.0788	0.0108	0.0246	0.0001	0.8355	0.2072	0.2501	0.0488	0.0081
19.2.99	GSI Camp	0.5899	0.3952	7.0804	0.0727	0.0058	0.0015	0.0010	0.5012	0.2453	0.6730	0.1028	0.0127
15.2.99	GSI Camp	1.5267	0.0811	6.8390	0.0864	0.1129	0.0214	0.0001	0.7156	0.2203	0.1619	0.0053	0.0065

Date	Station	Fe(μg/m³)	Cu(μg/m³)	si(μg/m³)	Pb(μg/m³)	Mn(μg/m³)	Cd(μg/m³)	Ni(μg/m³)	Al(μg/m³)	Cr(μg/m³)	Zn(μg/m³)	Hg(μg/m³)	As(μg/m³)
22.2.99	GSI Camp	1.9895	0.1125	6.3588	0.1237	0.1371	0.0031	0.0001	0.9936	0.2111	0.1812	0.0095	0.0069
24.2.99	GSI Camp	3.3316	0.2417	6.6691	0.2016	0.1618	0.0299	0.0001	2.0339	0.2241	0.2493	0.0128	0.0037
8.2.99	Korba	4.0758	0.0174	2.6894	0.1246	0.0542	0.0171	0.0207	1.9387	0.0515	0.3709	0.1354	0.0093
6.2.99	Korba	2.7398	0.0372	3.8057	0.1714	0.0359	0.0284	0.0160	1.0157	0.0468	0.2868	0.1093	0.0074
10.2.99	Korba	3.1252	0.1483	5.9664	0.3073	0.0432	0.1648	0.0091	3.0079	0.1056	0.3387	0.0156	0.0075
12.2.99	Korba	0.5592	0.0231	3.3729	0.2648	0.0070	0.0310	0.0001	0.6403	0.1723	0.1634	0.0833	0.0091
15.2.99	Korba	2.9164	0.0439	3.8499	0.0966	0.0193	0.0016	0.0002	1.1678	0.2139	0.1414	0.1333	0.0047
17.2.99	Korba	2.2122	0.0349	6.5551	4.2588	0.0298	0.0017	0.0002	3.3938	0.3403	0.2889	0.0132	0.0122
19.2.99	Korba	1.2801	0.0713	7.3447	0.0324	0.0072	0.0115	0.0003	0.7345	0.3407	0.3136	0.1146	0.0071
22.2.99	Korba	1.8233	0.0828	6.8941	0.1132	0.1379	0.0010	0.0001	1.1970	0.2176	0.1720	0.0126	0.0024
24.2.99	Korba	2.6723	0.1554	8.3659	0.0798	0.1531	0.0025	0.0002	2.4118	0.2301	0.2151	0.0089	0.0026
6.2.99	Manikpur	1.3115	0.0357	3.3680	0.3016	0.0173	0.0215	0.0062	0.6577	0.0878	0.2764	0.0281	0.0082
8.2.99	Manikpur	1.5345	0.0475	3.5582	0.2186	0.0220	0.0390	0.0062	1.5478	0.0929	0.2122	0.0349	0.0075
10.2.99	Manikpur	1.1698	0.0167	1.8361	1.8591	0.0132	0.0139	0.0012	1.3338	0.1410	0.3575	0.0034	0.0125
12.2.99	Manikpur	0.1768	0.0554	1.9988	0.1400	0.0052	0.0238	0.0002	0.4787	0.1502	0.1352	0.0843	0.0079
15.2.99	Manikpur	0.3951	0.0480	4.3781	0.0242	0.0026	0.0012	0.0001	0.3817	0.2017	0.1585	0.1068	0.0061
17.2.99	Manikpur	1.3889	0.0379	4.5020	1.4193	0.0155	0.0684	0.0004	0.9868	0.1832	0.1816	0.0047	0.0066
19.2.99	Manikpur	1.3288	0.0984	5.6482	0.7220	0.0926	0.0056	0.0002	1.1221	0.1837	0.1200	0.0818	0.0071
22.2.99	Manikpur	1.3161	0.0718	4.8364	1.3528	0.1033	0.0006	0.0001	1.2033	0.1670	0.1623	0.0611	0.0085
24.2.99	Manikpur	1.1027	0.0558	5.9619	0.0514	0.0972	0.0011	0.0002	0.6136	0.1667	0.0962	0.0029	0.0033

Monsoon Season

Date	Station	Fe(µg/m^3)	Cu(µg/m^3)	si(µg/m^3)	Pb(µg/m^3)	Mn(µg/m^3)	Cd(µg/m^3)	Ni(µg/m^3)	Al(µg/m^3)	Cr(µg/m^3)	Zn(µg/m^3)	Hg(µg/m^3)	As(µg/m^3)
14.8.99	Nonbirra	0.9587	0.6269	4.3258	0.0061	0.0362	0.0130	0.1473	1.7572	0.0728	0.3669	0.0005	0.0408
16.8.99	Nonbirra	0.8803	1.3483	4.3020	0.0041	0.0491	0.0127	0.1704	0.8185	0.0685	0.2310	0.0002	0.0418
18.8.99	Nonbirra	1.3423	1.3294	3.7748	0.0090	0.0238	0.0093	0.0929	1.7042	0.0710	0.1606	0.0059	0.0046
20.8.99	Nonbirra	0.4149	0.5707	4.8357	0.0385	0.0145	0.0112	0.1202	0.7170	0.0753	0.1719	0.0026	0.0005
23.8.99	Nonbirra	1.5588	1.4243	4.7712	0.0518	0.0270	0.0145	0.1438	0.5721	0.1100	0.1775	0.2193	0.0069
25.8.99	Nonbirra	0.7842	0.9032	7.1541	0.0067	0.0278	0.0121	0.1541	0.1495	0.1204	0.0958	0.0006	0.0140
23.8.99	* Nonbirra	2.2074	4.6718	7.6131	0.0184	0.0564	0.0131	0.1664	4.1490	0.1230	0.3121	0.0009	0.0165
14.8.99	Gevra	2.2060	3.0837	6.0681	0.0044	0.0367	0.0186	0.1739	3.7215	0.1015	0.2259	0.0222	0.0776
16.8.99	Gevra	3.4180	2.3719	6.0229	0.0117	0.0594	0.0178	0.1761	7.1129	0.1075	0.3256	0.0001	0.0521
18.8.99	Gevra	1.8855	1.9191	5.2763	0.0085	0.0256	0.0197	0.1345	2.0950	0.1493	0.2323	0.0067	0.0075
20.8.99	Gevra	2.8276	0.3223	6.4769	0.1205	0.0335	0.0125	0.1459	0.0016	0.1012	0.1416	0.0065	0.0058
23.8.99	Gevra	3.7864	2.1270	6.1111	0.0843	0.1006	0.0186	0.1868	15.0105	0.1319	0.3131	0.0426	0.0125
25.8.99	Gevra	1.6868	4.2921	10.3238	0.0785	0.0432	0.0175	0.2261	0.1430	0.1666	0.2701	0.0003	0.0208
14.8.99	A Nagar	3.1108	3.1819	5.1033	0.0361	0.0434	0.0175	0.1664	3.8320	0.0870	0.2457	0.0096	0.0532
16.8.99	A Nagar	1.7112	1.7902	5.0123	0.0073	0.0259	0.0136	0.1405	2.3120	0.0808	0.2141	0.0002	0.0495
18.8.99	A Nagar	1.3458	3.2995	5.7574	0.0153	0.0337	0.0127	0.1586	0.0015	0.1483	0.3936	0.0032	0.0107
20.8.99	A Nagar	0.7693	3.6864	6.2146	0.0154	0.0225	0.0189	0.1807	0.3857	0.1350	0.1564	0.0058	0.0139
23.8.99	A Nagar	1.3633	2.1701	5.5758	0.0474	0.0287	0.0134	0.1363	1.0870	0.0987	0.1315	0.0041	0.0138
25.8.99	A Nagar	0.6415	0.9063	6.3553	0.0120	0.0191	0.0107	0.2449	0.0012	0.1119	0.1023	0.0003	0.0155
14.8.99	GSI	2.0818	0.7804	5.4060	0.0111	0.0392	0.0166	0.1842	3.8161	0.0915	0.3990	0.0087	0.0584
16.8.99	GSI	2.3483	2.5603	6.8595	0.0093	0.0731	0.0188	0.1857	1.9788	0.1124	0.8053	0.0070	0.0620
18.8.99	GSI	1.9442	1.3337	6.8928	0.0083	0.0595	0.0158	0.1849	0.0035	0.1006	0.6360	0.0007	0.0079
20.8.99	GSI	2.2554	1.9312	7.2258	0.0069	0.0351	0.0149	0.1786	1.2411	0.1459	0.2754	0.0073	0.0189
23.8.99	GSI	1.8880	4.6359	6.6920	0.0436	0.0419	0.0144	0.1803	1.4716	0.1196	0.2409	0.0002	0.0154
14.8.99	Korba	4.5145	3.5187	6.4527	0.0593	0.0585	0.0228	0.2365	9.2998	0.1190	0.3072	0.0011	0.0554
16.8.99	Korba	3.1346	1.3703	6.0250	0.0478	0.0782	0.0170	0.1861	2.2347	0.1076	0.7207	0.0110	0.0719
18.8.99	Korba	3.4090	1.0256	8.6466	0.0136	0.0647	0.0233	0.2282	1.4681	0.1354	0.8607	0.2186	0.1663
14.8.99	Manikpur	1.8088	3.3665	5.1081	0.0104	0.3152	0.0174	0.2476	3.8530	0.1090	0.3804	0.0703	0.0458
16.8.99	Manikpur	4.4655	4.2995	7.6636	0.0140	0.0691	0.0184	0.2130	2.6780	0.1331	0.2743	0.0022	0.0785
18.8.99	Manikpur	2.2139	2.2661	4.9457	0.0076	0.0422	0.0120	0.1303	1.0070	0.0890	0.4964	0.0604	0.0273
20.8.99	Manikpur	1.0336	2.6001	6.2311	0.0040	0.0236	0.0196	0.1861	0.4296	0.1724	0.2037	0.0098	0.0123
23.8.99	Manikpur	0.9288	1.1565	5.4750	0.0186	0.0229	0.0103	0.1314	0.9049	0.0974	0.2104	0.0021	0.0124
25.8.99	Manikpur	1.2874	3.7071	4.9288	0.0811	0.0291	0.0092	0.1165	2.4658	0.0839	0.2725	0.0010	0.0099
23.8.99	*Manikpur	1.0467	2.2526	7.4036	0.0871	0.0358	0.0124	0.1594	0.9030	0.1180	0.1282	0.0001	0.0162

Date	Station	Fe(μg/m^3)	Cu(μg/m^3)	si(μg/m^3)	Pb(μg/m^3)	Mn(μg/m^3)	Cd(μg/m^3)	Ni(μg/m^3)	Al(μg/m^3)	Cr(μg/m^3)	Zn(μg/m^3)	Hg(μg/m^3)	As(μg/m^3)
22.5.99	A. Nagar	14.7351		45.1910	2.5448	0.4574	0.1588	1.2462	5.8730	0.2835	1.9458	0.0158	0.0179
24.5.99	A. Nagar	7.6886	11.1878	35.1360	1.7814	0.2508	0.1132	0.9648	6.3423	0.2244	1.2662	0.0059	0.0767
26.5.99	A. Nagar	28.1276	39.5475	61.0246	0.2888	0.9746	0.2599	1.7389	92.6330	0.6773	1.6767	0.0249	0.0449
28.5.99	A. Nagar	19.0806	13.3994	31.7854	0.0477	0.3076	0.2566	1.3051	53.5117	0.5731	1.4143	0.0036	0.0334
31.5.99	A. Nagar	23.2962	6.2519	19.6920	0.0226	0.6684	0.1275	1.1716	52.4097	1.6192	1.5311	0.1200	0.0526
2.6.99	A. Nagar	18.1534	8.6438	16.8739	0.0565	0.4453	0.1211	0.9762	40.7267	0.4513	2.0338	0.0480	0.0303
4.6.99	A. Nagar	13.2031	22.3825	18.7821	0.3370	0.3440	0.1013	0.9136	14.6488	0.4201	1.1350	0.1370	0.0417
4.6.99	G. Mines (1)	44.1208	12.4744	39.2699	0.8352	0.7541	0.2128	2.0336	89.6981	0.9320	2.7230	0.0199	0.0896
22.5.99	G. Mines (2)	39.5656	3.4888	59.6895	3.4811	0.9994	0.2152	1.9220	31.0385	0.9939	2.5438	0.0213	0.0611
24.5.99	G. Mines (2)	30.2623	12.4707	74.6822	3.5467	0.6757	0.2244	1.9400	23.2937	1.6174	2.0623	0.0229	0.0323
26.5.99	G. Mines (2)	60.5875	47.7531	73.3362	6.0689	1.0653	0.3268	3.4181	68.9183	1.4097	8.9861	0.1929	0.1195
28.5.99	G. Mines (2)	87.6005	91.8280	110.8866	3.3924	1.2579	0.5981	4.4493	243.9160	1.5916	4.2151	0.0146	0.1258
31.5.99	G. Mines (2)	44.2566	17.0323	54.2133	0.0633	1.9048	0.2983	2.4153	120.2818	0.7870	7.2403	0.2626	0.0869
2.6.99	G. Mines (2)	51.4886	6.4477	62.5019	0.1603	1.0363	0.2895	2.6558	69.9836	1.7965	2.9945	0.0618	0.1241
7.6.99	G. Mines (2)	49.6833	41.5224	62.5405	0.8797	1.1963	0.2555	2.5686	53.0143	1.4781	6.1309	0.1253	0.1004
22.5.99	G.S.I.	19.0886	4.3711	42.3210	2.4750	0.5677	0.1560	1.3080	16.7694	0.1082	1.6037	0.0350	0.0208
24.5.99	G.S.I.	22.7992	23.6510	78.0230	5.3020	0.8724	0.3389	2.8051	20.7068	0.1665	2.3766	0.1243	0.0900
26.5.99	G.S.I.	23.2148	9.8314	43.2589	0.3638	0.9033	0.2146	1.5853	73.2206	0.6019	1.7089	0.0071	0.0403
28.5.99	G.S.I.	21.0621	33.6034	33.6034	0.1032	0.5281	0.1797	1.3909	53.4534	0.4462	1.2517	0.0320	0.0424
31.5.99	G.S.I.	24.4113	4.5401	20.1448	0.0266	0.7041	0.1392	1.1270	120.2034	0.4206	1.8504	0.0715	0.0424
2.6.99	G.S.I.	38.8025	10.1966	68.1692	0.1523	1.2352	0.2314	2.1027	40.8829	1.9936	4.1215	0.2638	0.0687
4.6.99	G.S.I.	11.0320	1.3957	11.6641	0.1442	0.3832	0.0579	0.5637	22.5325	0.2527	1.7476	0.0027	0.0216
7.6.99	G.S.I.	22.0387	26.6424	27.0254	0.0431	0.2419	0.1051	1.0344	27.8961	0.5147	0.9041	0.0030	0.0409
22.5.99	Korba	10.9964	6.4794	24.4969	1.9693	0.3350	0.1050	0.8171	7.9982	0.0783	0.8342	0.0089	0.0138
24.5.99	Korba	16.6713	7.4211	19.5141	1.8983	0.3441	0.1136	0.7598	19.3945	0.6201	1.2303	0.0437	0.0278
26.5.99	Korba	16.2769	12.7405	23.9911	0.0941	0.5719	0.1167	0.7906	71.5757	0.4507	0.9378	0.0186	0.0264
28.5.99	Korba	15.8957	6.6469	20.8770	0.0599	0.3124	0.1162	0.9771	39.5204	0.3092	0.6208	0.0021	0.0283
31.5.99	Korba	21.3871	18.5904	21.0365	0.0440	0.5822	0.1146	0.9907	76.0168	0.8945	1.6526	0.0108	0.0285
2.6.99	Korba	18.7982	19.1911	20.7778	0.0370	0.1980	0.0920	0.8651	62.2805	0.4543	1.0521	0.0023	0.0289
4.6.99	Korba	20.5389	24.5067	19.4720	1.4079	0.2934	0.1101	0.9136	50.1387	0.5061	1.2571	0.0964	0.0333
7.6.99	Korba	12.7694	56.1580	67.9299	0.5687	7.8408	0.2424	2.4240	40.6139	1.3149	1.8774	0.0069	0.1253
22.5.99	Manikpur	19.0622	5.2547	29.0972	2.0614	0.5672	0.1120	0.9864	15.9757	0.0935	1.5212	0.0299	0.0153
24.5.99	Manikpur	9.9459	11.2926	29.0904	1.9373	0.2037	0.1234	1.0893	32.7112	0.8549	0.8934	0.2983	0.0360
26.5.99	Manikpur	22.0437	21.5673	40.9190	0.1074	0.3361	0.1460	1.0541	101.0805	0.3573	1.0808	0.0289	0.0430

Date	Station	Fe(μg/m^3)	Cu(μg/m^3)	si(μg/m^3)	Pb(μg/m^3)	Mn(μg/m^3)	Cd(μg/m^3)	Ni(μg/m^3)	Al(μg/m^3)	Cr(μg/m^3)	Zn(μg/m^3)	Hg(μg/m^3)	As(μg/m^3)
28.5 99	Manikpur	15.9024	15.3268	18.3975	0.1105	0.3806	0.1163	0.9033	38.4611	0.5254	0.7510	0.0344	0.0133
31.5.99	Manikpur	22.6664	21.9801	23.0741	0.0995	0.2636	0.1327	1.1786	56.6410	0.7185	0.8707	0.0465	0.0373
2.6.99	Manikpur	18.7413	28.2281	28.8049	0.0708	0.3387	0.1403	1.1867	47.2351	0.5024	1.6931	0.0291	0.0422
4.6.99	Manikpur	21.0819	15.2462	25.0533	1.4185	1.0139	0.1191	1.1926	21.5035	1.4131	1.4101	0.0032	0.0379
22.5.99	Non birra	9.4233	11.8878	35.6577	3.5574	0.3186	0.2311	1.0668	6.5625	0.4806	1.5288	0.0168	0.0332
24.5.99	Non birra	13.9600	4.2136	33.0589	3.4615	0.2944	0.2030	0.7947	5.8009	2.3043	1.0478	0.0246	0.0092
26.5.99	Non birra	12.6509	3.4788	21.1575	1.7862	0.2141	0.1044	0.8601	6.1124	0.1508	0.8695	0.0485	0.0095
28.5.99	Non birra	12.7247	5.4052	32.9233	0.1110	0.4494	0.1185	0.8322	34.4380	0.3003	1.5515	0.0860	0.0271
31.5.99	Non birra	14.5459	4.7901	17.0754	0.0408	0.3230	0.0937	0.8028	43.5230	0.3381	0.5738	0.0466	0.0957
2.6.99	Non birra	14.4384	8.5564	20.6687	0.0556	0.3778	0.0947	0.8238	17.1202	0.4561	1.3087	0.1111	0.0272
4.6.99	Non birra	7.7239	10.6118	15.7254	0.0126	0.2983	0.0913	0.7606	3.4706	0.3327	1.1204	0.0916	0.0286
7.6.99	Non birra	22.2558	10.1625	22.3134	0.3221	0.3533	0.0893	0.9013	33.9284	0.8800	0.8895	0.0020	0.0322